



MASB 46-89

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## Strip Laminate Rocket Motor Cases

**Background.** Royal Ordnance plc, U.K., has pioneered a unique capability in producing strip laminate rocket motor cases that are successfully meeting the stringent requirements of the insensitive munitions initiatives that are being incorporated into the design requirements of military munitions. Royal Ordnance plc is one of the world's leading designers and manufacturers of weapon systems and has supplied British sources for more than 400 years. The Rocket Motors Division of Royal Ordnance located at Summerfield and Westcott in England has comprehensive experience across the whole range of rocket propulsion systems that are used in land, sea, and air guided missiles, underwater and in space.

The Rocket Motors Division's experience also extends to rocket motor case construction using a wide range of materials including the unique strip laminate process. Other rocket motor components such as nozzles, ignition devices, and thrust vector control systems and associated products such as gas generators, power cartridges, and igniters are also covered.

**Discussion.** The strip laminate system of rocket case manufacture is a technique that combines conventional metal technology with advanced laminate bonding. Cases constructed in this manner retain the advantages of metal construction; i.e., high strength, flexural stiffness, and robustness, and add the advantage of reinforced plastics by producing highly accurate tubes and giving freedom from explosion when the rocket motor is subjected to fragment attack or immersion in fire.

When subjected to fragment attack or external fire, conventional rocket motors invariably explode with varying degrees of violence. In high density storage and launching systems, the violence of the reaction can compromise the viability of a fighting unit. Such attacks on a strip laminate motor result in extensive delamination of the motor case, thus preventing a buildup of internal pressure and reducing the incident from that of explosion to one of fire.

**Manufacturing Process.** The simple process enables tubes to be wound limited in diameter and length only by the size of the winding machine. The process consists of winding a number of layers of adhesively coated metal strip onto a mandrel equal in diameter to the bore of the required rocket motor. After being removed from the mandrel, the wound tube is cut to length, has

end and wing fittings, and is bonded into place before being finally cured to produce a high-quality rocket motor case.

Once prepared and coated with resin, the steel strip can form a strategic stock of extremely long shelflife and held against any future rocket motor requirement. While almost any metal strip can be used, the standard is 0.25-mm-thick high tensile steel of 2000 MN/m. (See Figure 1.)

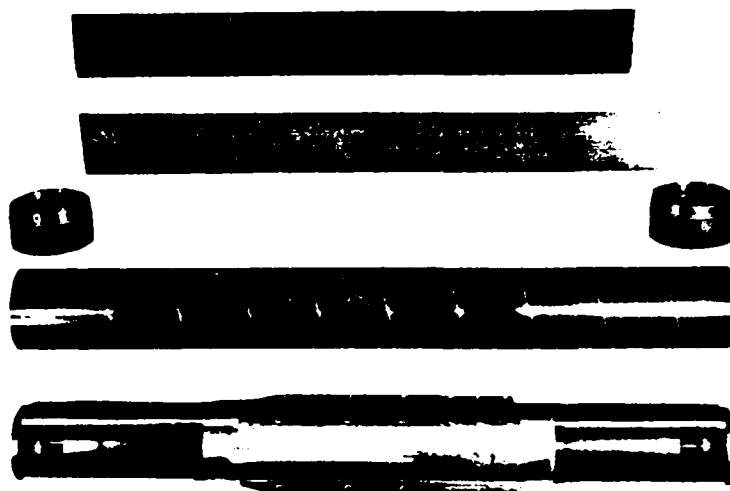


Figure 1. Strip Laminate Rocket Motor Case from starter strip through to finished case.

From this type of strip, many types of rocket motor tubes have been manufactured up to approximately 1-m diameter x 3-m long. They have been in production for the Rapier missile program. Straightness limits of 1/1000 or better are achieved in tubes with mechanical properties identical to those manufactured from homogenous material.

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